

ETATM
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ADVANCED GEOTHERMAL HEATING AND COOLING

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June 12, 2009

Mr. Jerry Farrell, Jr., Commissioner
c/o Ms. Elisa Nahas, Esquire
State of Connecticut
Department of Consumer Protection
Suite 100
165 Capitol Avenue
Hartford, Connecticut 06106

RECEIVED

JUN 15 2009

DEPT OF CONSUMER PROTECTION
OFFICE OF THE COMMISSIONER

Re: DX Geothermal Informational Session

Dear Commissioner Farrell and Ms. Nahas:

Thank you for including me in your request for comments on June 8, 2009, regarding DX Geothermal systems.

During the course of the hearing, two issues appeared to be of understandable primary concern. Namely, cathodic protection for copper tubing and DX system installation training.

Regarding cathodic protection, Ms. Nahas was gracious enough to permit me to provide a brief explanation on the record. In summary, there are various types of cathodic protection that may be utilized to reasonably protect copper in corrosive sub-surface conditions. Examples would be coupling the copper to a sacrificial anode (such as zinc, magnesium, or even steel), or coupling the copper to an appropriate electrical current. However, the anode will deteriorate over a period of years, and electrical supplies may be interrupted.

Consequently, an alternative viable means of protecting sub-surface copper tubing might also be considered that simply prevents the tubing from contacting the corrosive elements in the first instance. This can be accomplished via encasing the tubing within cementitious Grout 111 and/or coating the tubing with a protective coating of polyethylene, as more fully explained in my prior letter of June 4, 2009, marked as Exhibit #1.

If a baby is kept away from touching a hot stove, the hot stove cannot burn the baby. Similarly, if the sub-surface copper tubing is not permitted to touch the corrosive sub-surface environment, the copper tubing cannot be corroded. Although sub-surface conditions that are corrosive to copper (commonly a pH below 5.5 or above 11) do exist, such conditions are generally rare. Limestone, which I have been told comprises much of Connecticut's sub-strata, is typically very friendly to copper.

Regarding training, several DX companies related they provide DX system installation training, comprised of in-field training for at least one to two days and/or classroom training followed by a written exam. In this regard, I respectfully submit that while training would obviously be appropriate for any unfamiliar technology, the type and degree of training depends on the complexity of the technology.

For example, the training required to fly a 747 passenger jet is not the same degree of training required to fly a radio controlled model airplane, although both are aircraft.

Similarly, all DX systems are not alike. For example, as related at the hearing, Earth Linked DX systems utilize multiple angled wells, that require insertion of multiple copper tubing loops at reported thirty-degree angles, within boreholes only one to three inches in diameter. Consequently, these installations can require somewhat specialized expertise, and the small boreholes can make proper grouting challenging (as per hearing testimony). Also, of course, the array of multiple tubing loops are reported to be typically joined to common and primary vapor and liquid refrigerant transport lines in a centralized underground location, or pit. The joints and loops are then reportedly tested for leaks in the field with 400 psi.

To the contrary, Earth To Air Systems, LLC ("ETA") utilizes only one to two vertical wells per 1.5 to 7.5 ton system, which wells extend directly and vertically (not angled) down to 500 foot depths, which wells are typically 5 to 6 inches in diameter (not 1 to 3 inches in diameter), and are therefore very easy to properly grout. A pre-built and non-leak copper tubing loop, with a protected and weighted lower distal end, is unrolled off a cardboard spool and lowered into the well. The loops have already been pre-tested for leaks at the factory. Thus, it does not require a full day of training and a written test to teach a new installer how to drop a pre-built ETA system factory loop straight down a hole.

Further, when there are more than one well, the ETA loops are typically combined/distributed indoors, and above-ground, at the side of the ETA compressor box (not below ground). Thus, any licensed HVAC technician who can braze can easily connect the one or two loops. As mentioned, the ETA copper loops do not leak, because, instead of being pressure testing to 400 psi (as other DX companies do via hearing testimony), ETA pre-tests all loops via pulling a 250 micron vacuum (typically a superior leak testing procedure) prior to inserting a field verifiable dry nitrogen holding charge at the factory.

The ETA compressor unit only has two mechanically/electrically operated moving parts, a compressor and a reversing valve. The reversing valve only engages when one switches the thermostat from heat to cool, or vice versa. Thus, again, while only a licensed HVAC technician may work on an ETA system, the training required is minimal, and is typically accomplished in only one day, or less, of on-site training. An ETA system is as efficient and quiet as a stealth aircraft, but is as simple to install

and operate as a radio controlled model airplane. Some instruction is necessary, but not a lot.

Factually, the sub-surface portions of water-source geothermal systems are far more challenging to install than an ETA DX system. Closed-loop water-source systems require proper air bubble venting, a correct installation of anti-freeze, a correct installation of rust inhibitor, correct butt fusing (melting the plastic pipes together) of multiple joints, and a correctly sized and installed water pump, all in addition to proper grouting. I do not know if Connecticut requires training for water-source system installations.

Also, factually, ETA systems are even simpler to service than conventional air-source heat pumps, as there is no exterior de-frost cycle, and there is no complicated circuitry/controls, required with an ETA system design.

Thus, the training required for a new ETA system installer is actually minimal, because the system is so simple to install and operate. Therefore, you are respectfully requested not to legislate lengthy training requirements for all DX systems, as this would be a waste of time and money for ETA system installers, which extra and unnecessary costs would only be passed along to Connecticut consumers/residents. It would be unjust to penalize technologies (such as ETA's) that are specifically designed for easy installation/operation, via imposing unnecessary and more stringent training requirements than might otherwise be necessary for more complicated DX system designs. (As explained, water-source geothermal systems are typically more complicated to install than an ETA DX system). Perhaps requiring an installation certificate from the equipment manufacturer (whether DX or water-source) might be a consideration, while leaving the training requirements up to the company selling the particular system, since, depending on respective system complexity, some equipment training will necessarily be more intense than for other equipment designs.

Realistically, it is respectfully suggested that the significant issues of concern are neither the type of geothermal system installed (water-source or DX), nor whether or not a licensed HVAC technician has been trained for one or three days on how to install a geothermal system. Instead, the real issues of concern are the safety to the sub-surface environment and groundwater for the people of Connecticut. (By the way, simply having a technician attend a class and pass a written test, at an unknown level of complexity, with a grade of 70, does not necessarily insure 100% accuracy on in-field installations of complicated equipment.)

However, achieving some reasonable degree of safety in drilling wells can be accomplished via simply requiring duly licensed well drillers to drill all geothermal boreholes (which the well-drilling lobby is clearly in favor of, and which, as I recall from hearing testimony, insures years of drilling experience and training already accepted by the State), and to require that all wells be filled with environmentally safe grouts, such as a cementitious Grout 111 (developed by Brookhaven National

Laboratory), or the like. Licensed well drillers are probably already required to report the location of completed wells. Thus, in addition to already being qualified to drill, they probably already record all actual well locations. It would be easy for them to simply mark respective wells as a geothermal well (or as a water well) on their final report. Perhaps this is already required for water-source geothermal systems in Connecticut. If so, the well drillers could also easily identify the type of geothermal well on their final report, whether water-source or DX.

I understand that other DX companies would like to drill their own wells, in lieu of having to utilize already licensed well drillers. In this regard, for the benefit of other DX companies, I understand consideration might be given for anyone to drill relatively shallow wells for any purpose, inclusive of DX system wells. For example, I do not know if permits are required to drill wells for fence posts, for telephone poles, etc. Perhaps there is some maximum depth that may be acceptable for anyone (after they have made the already requisite One Call for underground utilities).

Regarding technical training on DX system interior equipment, such as compressor boxes and air handlers, again, various DX systems (such as ETA's) are simpler than a water-source geothermal system, and are even simpler than various air-source systems, as no defrost cycle is required with DX system design. All of the systems are basically heat pumps. Each system is different, just as a Trane unit may differ from a Carrier unit, which may differ from a Lennox unit, etc. Further, there are typically multiple system sizes and designs made by the same respective DX companies, just as there are via respective water-source and air-source heat pump companies. I doubt training is legislated by Connecticut for all heat pump systems installed within the state. DX should not be singled out because of a strong anti-DX lobby.

Further, there are already established and recognized state and federal licensing requirements pertaining to HVAC companies and pertaining to the handling of refrigerants. Generally, anyone holding such necessary licenses should be qualified to install any refrigerant based heat pump system, after receiving appropriate initial training from the system manufacturer, which training should be dictated by the respective manufacturer.

By way of additional brief comment to several issues raised by Mr. John Sima at the hearing, I would respond as follows:

1. Oil, acknowledged by Mr. Sima to be harmless, potentially getting into the water supply:

ETA systems utilize a unique and highly efficient oil separator to remove virtually all of the environmentally safe and harmless oil from the refrigerant before it ever enters the copper tubing in the ground. However, the oil, even if poured directly into the water at full strength in large quantities (which would never happen), is much safer than some anti-freeze and/or leak plug compounds routinely utilized by

water-source entities. A copy of the material safety data sheet for polyolester (used by ETA with R-410A refrigerant) is enclosed, evidencing it is safe.

Factually, there is much less oil in most any DX system than there is in a car. The oil in a DX system, particularly polyolester as used by ETA, is not hazardous. The oil and gasoline in a car is hazardous. Cars are not prohibited from use because a car could possibly go off a bridge into a river supplying drinking water to a town. The encasement of copper tubing within a cementitious grout, as done by ETA in well/borehole systems, further insures that, even if a highly improbable leak did ever develop in an ETA ground loop, the minimal amount of environmentally safe oil potentially escaping would be contained within the cementitious grout seal.

2. Water freezes and thaws around sub-surface copper pipes:

First, this is irrelevant. Water freezes and thaws around copper tubing on most all air-source heat pumps in the Northern hemisphere when the exterior temperature is near, or below, 40 degrees F, at which point the system typically operates in a de-frost cycle when in the heating mode. This does not harm the copper tubing, as has been apparent for decades. (Water also freezes and thaws around metal tubing in freezers without incident) However, ETA surrounds its copper tubing with cementitious Grout 111, which means the sub-surface copper tubing utilized for heat transfer is not even exposed to water. Thus, freezing and thawing around the sub-surface copper heat transfer tubing of an ETA system, even if it was relevant, would not be an issue for ETA in Connecticut.

3. If water enters a DX system through a leak, the entire system would need to be replaced:

Initially, this is not a primary health hazard issue, this is a repair cost matter. If water enters one's upstairs bedroom via a leak in the roof, this is not a primary health hazard, this is a repair cost matter. If the refrigerant to water heat exchanger in a water-source system leaked, the problem would be the same. Fortunately, water can be rather easily evacuated from most any heat pump system via pulling a 250 micron vacuum. If a water leak developed in the bottom of any geothermal heat pump system's well (DX or water-source), the safest option would be to replace the specific leaking well. Normally, however, the rest of the equipment would be OK, and still fully functional, after simply being cleaned. Again, this is a repair cost matter.

4. DX systems could create changes in ground/water temperatures which could be considered temperature pollution:

It is my understanding that, in fact, temperature rises of about 10 degrees have been observed in some geothermal field applications over a period of many years. However, it is also my understanding that in all such known applications, the sub-surface temperature rise has been created by water-source geothermal systems.

The heat build-up is apparently due to either the field loops being too close together (less than about 20 feet apart) and/or because the loops were too short ("short-looped") for the system design capacity. Sometimes, due to design error, or due to risk-taking to keep initial installation costs low, loops might have been shorter than necessary to adequately dissipate heat within a given area of ground. This is referred to as a "short-looped" well.

ETA generally requires its ground loops/wells to be 30 feet apart (20 feet apart is a minimum, and is permitted when there are only several loops involved), and requires full design depths of 100 to 120 feet per ton of system design capacity in most applications. Because of an extra heat transfer step, transferring heat through plastic instead of through copper, etc., heat transfer is poorer in a water-source system than in a DX system. This poorer heat transfer rate means a water-source system typically needs about 180 feet to 250 feet per ton of system design capacity, which, of course, requires more virgin soil disturbance than does a DX system.

In properly designed loops, the ground surrounding the heat transfer tubing will warm up during the summer, but will cool down during the winter, with the ultimate effect of the ground in the immediate vicinity of the loops acting like a giant thermal storage bank, for the benefit of the homeowner/business owner. Via thermal transfer testing, ETA has tracked, under stressed cooling mode conditions, decreasing temperatures to a point 12 feet away from the central heat exchange tubing in naturally occurring soils. Beyond 12 feet, there was an indistinguishable temperature gradient from natural virgin ground temperatures about 50 feet away. This is why ETA normally recommends a 30 foot normal well/borehole distance separation (12 feet from the center of one well, plus 12 feet from the center of another well, plus a 6 foot safety margin). However, via over 7 years of testing, ETA has found that borehole separations of 20 feet imposes no significant concern when only several wells are involved in a particular application.

Further, since a five ton geothermal system either rejects 60,000 BTUs of heat into the ground in the cooling mode, or removes 60,000 BTUs of heat from the ground in the heating mode...whether or not the geothermal system is a DX system or a water-source system, any argument that sub-surface thermal gradients are a concern for DX systems, as opposed to water-source systems, is simply invalid.

Fortunately, ETA also has a proprietary means of eliminating excessive heat build-up in ground that has been over-stressed in the cooling mode, should the situation ever arise. Such a situation is highly unlikely to ever occur in Connecticut (where heating mode operation is more of an issue), unless a geothermal system has wells significantly too close together, or unless the system has been short-looped. In such a situation, the home/business owner would be well aware of the problem via insufficient cooling and/or abnormally high energy bills. Such a situation can be remedied via ETA's proprietary means, or by simply drilling additional wells, which, again, is primarily a repair cost issue.

In summary,

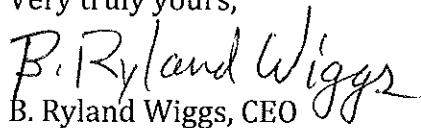
A. Cathodic protection of copper tubing is generally unnecessary, unless, for example, the pH is below 5.5 or above 11. Appropriate traditional cathodic protection means, such as using a sacrificial anode or an electric current, are viable, but copper tubing can also be protected from potentially corrosive environments via surrounding the copper with a cementitious grout (such as Grout 111) and/or by coating the tubing with a protective plastic coating. A cementitious grout and/or a plastic coating are not subject to eventual depletion or to a loss of power.

B. Training requirements will materially vary depending on the complexity of any particular geothermal system, whether DX or water-source. To penalize a well-designed simplistic geothermal technology via imposing extensive training requirements, because other geothermal technologies are far more complex, would be unjust. It could be appropriate to let individual geothermal system manufacturers, including both DX and water-source, develop their own training requirements. HVAC and refrigerant technicians are already required to receive appropriate training, and to pass well-designed uniform written state/federal exams, before receiving their licenses.

The actual concern to the residents of Connecticut is the ultimate safety of the sub-surface environment. This can be accomplished via requiring already qualified and licensed well-drillers to drill geothermal wells, at least beyond some minimal near-surface depth, which minimal depth might be considered relatively inconsequential.

C. Other miscellaneous issues raised, such as compressor oil, freezing water, water leaking into a heat pump system, and sub-surface thermal gradients, have been respectively addressed hereinabove, and pose no reasonable significant basis to prohibit DX system installations within Connecticut.

Very truly yours,


B. Ryland Wiggs, CEO